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Cooking by Gas.

A correspondent of the *American Artisan* says: Gas-cooking apparatus are by no means new. Their cleanliness and convenience are evident both to housekeepers and inventors, and quite a number of devices of the kind have been suggested. Abroad, they seem to have become a staple article in the hardware line, and to have been quite widely adopted. In this country the case is different, and we do not know of a single pattern on sale or in use. But it appears as if it were only necessary to bring out a really good thing to insure for it a favorable reception Gas companies would be likely to promote its introduction, because it would lead, in a measure, to an increased consumption of their manufacture, and there are many cases, even in dwellings, where the fire is never allowed to go out in the stove or range, where a gas burner fitted with adjuncts for cooking would pay its cost in a single week.

Such a device need not call for any extreme outlay of ingenuity in its production, although there is abundant chance for the introduction of patentable and desirable improvements. One of those displayed in the London shops comprises simply an iron stand having a burner, on the Bunsen principle, at one corner. Upon the stand is an enameled iron dish, arranged at an inclination so that the gas-flame will spread and play over the bottom. Upon the dish is a frame of galvanized wire, the office of which is to sustain the joint or substance to be cooked, out of immediate contact with with the dish. Upon the whole is applied a cover to retain the heat, but which is so formed that while the joint of meat is roasting within a coffee-pot may be heating on top. Of course, by changing the shape of the cover, or by replacing it by a cylinder, a vessel could be placed above the dish and heated for stewing, etc. By placing a dish of sheet-copper or other metal in place of the enameled dish, the flame may be readily used for heating irons, and for many other purposes that will readily suggest themselves. I do not undertake to say in what manner this simple apparatus could be better adapted in common use, but do suggest that a cheap and efficient apparatus for cooking by gas would deserve success, and would be more than ordinarily likely to get it. I have seen in this city a large gas stove heat a room of very considerable size, and its cleanliness and cheapness were the admiration of all who saw it.

Induration of Wood.

There are signs that, unless some improvement be devised in the texture of the material used, wood pave ments will very soon "play out." We note the statement that in Chicago, where one hundred and fifty miles of streets have, from first to last, been paved with it, the cost of maintaining the old and of laying new amounted last year to nearly two million and a half of dollars. In New York city, where the pavement is laid in narrower streets than in Chicago, the wear is more rapid, and the cost, it is safe to assume, much greater. The expense of wood pavement is a positive thing, apparent at a glance, and taking the most tangible form in the guise of taxes. Its advantages and economy are not less great, but are less easily appreciated. We do not doubt that the saving to the public in wear and tear of vehicles and damage to draught and carriage horses would pay for relaying wood pavement every two or three years. Neither would we dispute the proposition that the approximate noiselessness secured by this pavement, and the quiet and comfort resulting therefrom, would be cheaply purchased at the price of the increased taxation. But it is hardly to be expected that this view of the case should generally obtain, and it is evident from the comments of the newspaper press, in most localities where the pavement has been tested, that a strong tide of public opinion is setting against its use. To stem this will necessitate, as we have hinted, some means of doing away with the perishability of the material upon which, remotely, the opposition to this method of surfacing streets is based.

Wood, for the use indicated, must be guarded against two sources of destruction, decay and abrasion. For the first there are numerous efficacious preventives, differing in character and cost; for the other there is at present none that can be relied upon. Wood has been saturated with a chemical substance in such manner that, when impregnated with a second, a solid substance would be deposited in the pores, thereby securing induration and consequent hardening. This process, whatever the chemicals used, is most efficiently carried into practice by forcing the chemicals in solution lengthwise through the wood by hydraulic pressure. We believe that experiments in this line, if successful, would lead to important public benefits, and also prove remunerative to the inventor. As the material would be both waterproofed and fireproofed by the process, there would be many uses other than that designated to which it could be advantageously applied in engineering, and in more than one department of the arts.—*Am. Artisan.*

The Oil Regions.

New wells have been so numerous during the last few weeks that their announcement is becoming monotonous; and, strange to relate, the announcement of a hundred-barrel well every few days has not as yet permanently affected the market rates. Throughout the season, so far, prices have been better maintained than we have ever known. The daily production, taking last month's petroleum report as a basis, is liable to be increased during the present month, but not, we think, to any alarming extent. The amount of development required to make any increase above the general average is greater than the general reader would imagine. The number of wells now producing the present supply is about 3,200. The average life of a well, or the length of time it continues its largest production, is seldom over two months, and more generally that many weeks, and not unfrequently a few days. From the time the well has reached its greatest production, the decline or decrease of the same is rapid and certain. When the well has reached its lowest stage, torpedoes are applied, and a reasonable per cent. of such wells may be increased by this means. When this cannot be done, wells are either abandoned or pumped one or more times each day.

From this explanation, it will be seen that a slight decrease on the part of the 3,200 wells in operation, will absorb a good many hundred-barrel wells. And to keep up an average production also requires the drilling or commencement of some three hundred new wells each month. Of these only a portion prove producing ones. Although large oil fields are constantly being opened up by the extensive development, the chances of a production large enough to glut or overwhelm the market are each year growing far less. Men of capital have for several years been engaged in buying up all the territory giving promise of being productive. These tracts, when developed by a good well, are not leased as in former days, and the surface pepper-boxed by a myriad of wells. The owners refuse to lease and develop their lands, which is, of course, a slower process, and less liable to throw a large supply on the market when the demand will not justify. The fact that the production can be increased so as to be ample for any remunerative demand, will do more to give permanence to our general business than anything else. The operators of the hills and valleys of Venango and adjoining counties have the precious article on draught, The civilized world are as insatiate in their demands as Oliver Twist appeared to the virtuous Mr. Bumble, and are continually asking for more; and we can supply them as long as they can pay for it.—*Oil City Register.*

Street Lamp.—A Mr. Skelton, of London, has recently invented a street lamp, with strips of looking-glass arranged in its roof, somewhat after the manner of a Venetian blind. He thus reflects into the street rays of the light which would otherwise have gone over the houses. The results of experiments on this lamp, it is said, show that the street receives three times as much light as would fall upon it from lamps of the ordinary kind.

Gas Explosion in England.—A fearful explosion of gas occurred on the 13th inst. at Leeds. One or two persons were killed, and several were badly injured.—*Despatch to Associated Press.*

Chemical Repertory,

No. 59.—November 16, 1871,
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

97. Internal Corrosion of Steam Boilers.—H. Sainte-Claire Deville, in a recent important paper, ascribes the singular erosion of the iron of steam boilers by distilled water, by the fact that iron is slowly attacked by steam at 140° C. The oxide formed by steam acting on iron at the temperature of 440° C. has a composition corresponding to $Fe^4 O^5$; it is amorphous, black, magnetic, is scarcely affected by nitric or sulphuric acids, but is readily soluble in cold hydrochloric acid, forming a deep brown solution, with which potash forms a black precipitate. The remarkable fact is clearly elicited, that iron is much more acted on at low temperatures than at high ones.

[We have already, in these columns, some three years since, in an article entitled "Chemical Engineering," written on this subject of internal corrosion, attributing it to the action of the steam, in conjunction with that of the *free oxygen* always found naturally dissolved in aerated waters, in converting the iron surface into hydrated protoxide of iron, which is quite *soluble in water*. We still believe that, in practice, this action would be found to be at least concomitant with that supposed by Deville; and, in fact we are not prepared to accept the notion of this chemist at all.—Ed.]

98. Removal of Aniline Colors.—(*Musterzeitung fur Farberei* 1870, *No.* 17).—Goods dyed with aniline colors may easily be rendered white by the use of of zinc gray; the metallic zinc contained in this powder reduces the colors, forming soluble colorless products. To apply the principle—Triturate 100 grms. zinc gray with 50 grms. mucilage, marking 20° B., until the mixture is homogeneous; incorporate with this 20 grms. of a solution of hyposulphite of soda, marking 20° B., apply this mixture directly to the goods, let it dry and vaporize. After this operation it is best to wash the goods with water slightly acidulated with hydrochloric acid.—*Am. Chemist.*

99. On the Force of Detonation of Gaseous Mixtures.—Berthelot.—According to the recent researches of this great chemist, the maximum work which can be done by a kilogram of various gaseous explosive mixtures, varies only from simple to double, and is nearly the same for the different hydrocarbon gases. This work surpasses that of all solid or liquid explosive compounds. With oxygen and hydrogen, for example, it is five times that of ordinary powder and 2½ times as great as that of nitro-glycerine. With the hydrocarbon gases, it is 4 times that of powder and double that of nitroglycerine.—*Academy of Sciences.*

100. A Wonderful Diamond Specimen.—T. W. Tobin writes to the *Chemical News* from the South African diamond fields, that he possesses, and will be in England the middle of November, to exhibit to the Chemical Society, a mass "consisting of some hundreds of diamonds cemented to a core of foreign substance. Amongst the mass there appear garnets and other bodies. The weight of the entire specimen is 19 carats."

101. "Tailings."—About 300 years before the Christian Era, the silver mines of Laurium, in Attica, were exhausted and abandoned: but seven years ago a Franco-Italian Company obtained a concession to treat the scoria and other refuse for silver, and their operations have been conducted on so large a scale that a town containing 4,000 inhabitants has sprung up in what was formerly a solitude; a railway has been constructed to the nearest port, and a small steam vessel plies twice a week between Argosteria and the Piræus for the transport of the argentiferous tailings to the roasting furnaces."

102. Cleaning Glass Vessels wherein Petroleum has been Kept.—Dr. F. Stolba prescribes as follows: Thin *milk of lime*, used for washing glass vessels wherein the liquid alluded to has been kept, forms with the petroleum an emulsion, and renders it possible to remove any traces, and, by the addition of a small quantity of chloride of lime to a second washing with milk of lime, even the smell, so completely as to render the vessels so cleaned fit for pouring and keeping beer therein; if warm milk of lime be used, the operation, which otherwise takes considerable time for completion, is rendered shorter.

103. New Method of Incineration of Vegetable and Animal Substances.—A. Bechamp proposes the use of nitrate of bismuth, in the state of an aqueous solution of known strength, to be mixed with the material to be incinerated (in this paper yeast is mentioned, which is very difficult to burn off completely), provided the water contained in the substance has been previously ascertained by drying at 100°. The nitrate of bismuth solution (the bulk thereof to ignite and calcine readily 100 to 150 grms. of substance should contain from 3 to 4 grms. of bismuth) having been mixed with a fresh and weighed portion of the yeast, the mixture is first dried gently on a water bath, next heated on a sand bath hot enough to cause the mass to blacken, after which it burns away as tinder, and if required, the ignition is completed over the lamp. Should any fear exist that some metallic bismuth should have been formed, nitric acid is added to the ash, and the heating repeated, so as to destroy the nitrate of bismuth thus formed.—*Academy of Sciences.*

104. Meat Preserving.—A New Method.—Liebig's process has been carried on very profitably; but has been declared wasteful from the small amount of stimulating material preserved, and the carting away of all albumenoid matters to the manure-heap. A new plan has been introduced by Mr. T. F. Henley, who does away with steeping meat in water, and with boiling and otherwise treating it in a most costly way. He simply squeezes a definite amount of juice out of the fibre, and by mechanical desiccation preserves the latter intact. The pressed meat thus obtained contains 10 per cent. of alcoholic extract and salt, and over 50 per cent. of fibrin and other albumenoid constituents. It is exceedingly rich, and so is the meat-juice which Mr. Henley evaporates in vacuum pans. The juice contains about 15 per cent. of alcoholic extract, and over 50 per cent. of albumen. The ancient method of abstracting water only from the animal matter, is relied on as the preservative, and the low temperature at which the evaporation is carried on prevents any loss of flavor or other deterioration. The first works, on an extensive scale, are to be opened on the River Plate, on the Estancia Nueva Alemania, where cattle have been reared and fattened for the European markets. It is proposed to slaughter three hundred bullocks daily.—*British Medical Journal.*

105. Charcoal and Gases.—Hunter has given a great extension to the earlier experiments of Saussure on the absorptive power of charcoal for gases. Cocoa-nut charcoal, according to Hunter's experiments, exceeds all other varieties of wood-charcoal in absorptive power, taking up, at ordinary pressure, 170 volumes of ammonia, and 69 of carbonic acid. Methylic alcohol is more largely absorbed than any other vapor at temperatures from 90° to 127°; but, at 159°, the absorption of ordinary alcohol exceeds it. Cocoa-nut charcoal absorbs 44 times its volume of the vapor of water at 127°. The absorptive power is increased by pressure."—*Dr. Andrews's Address to the British Association*

106. The Benzole Group of Hydrocarbons.—In organic chemistry the labors of chemists have been of late largely directed to a group of hydrocarbons which were first discovered among the products of the destructive distillation of coal or oil. The central body round which these researches have chiefly turned is benzole, whose discovery will always be associated with the name of Faraday; with this body naphthaline and anthracene form a series, whose members differ by $C_4 H_2$, and their boiling points by about 140°. The recent researches of Lieberman have proved, as was before suspected, that chrysene is a fourth member of the same series. I may add that ethylene, which boils at about -70° corresponds in composition and boiling-point to a lower member of the same series.—*Ibid.*

107. Coal Tar Alkaloids.—Baeyer has prepared artificially picoline, a base isomeric with aniline, and discovered by Anderson in his very able researches on the pyridine series. Of the two methods described by Baeyer, one is founded on an experiment of Simpson, in which a new base was obtained by heating tribromallyl with an alcoholic solution of ammonia. By pushing further the action of the heat, Baeyer succeeded in expelling the whole of the bromine from Simpson's base in the form of hydrobromic acid and in obtaining picoline. The same chemist has also prepared artificially collidine, another base of the pyridine series.—*Ibid.*

108. Further Coal-Tar Chemistry.—The interesting work of Dewaar on the oxidation of picoline must not be passed over without notice. By the action of the permanganate of potassium on that body, he has obtained a new acid, which bears the same relation to pyridine that phthalic acid does to benzole. Thorpe and Young have published a preliminary notice of some results of great promise, which they have obtained by exposing paraffine to a high temperature in closed vessels. By this treatment it is almost completely resolved into liquid hydrocarbons, whose boiling-points range from 18° C. to 300° C.: those boiling under 100° have been examined and consist chiefly of olefines. In connection with this subject it may be interesting to recall the experiments of Pelouze and Cahours on the Pennsylvanian oils, which proved to be a mixture of carbohydrogens belonging to the marsh gas series.—*Ibid.*

109. Berthelot's Hydrogenation Method.—An elaborate exposition of Berthelot's method of transforming an organic compound into a hydrocarbon containing a maximum of hydrogen has appeared in a connected form. The organic body is heated in a sealed tube with a large excess of a strong solution of hydriodic acid to the temperature of 275°. The pressure in these experiments Berthelot estimates at 100 atmospheres, but apparently without having made any direct measurements. He has thus prepared ethyl hydride ($C_2 H_6$) from alcohol. aldehyde, etc.; hexyl hydride ($C_6 H_{14}$) from benzole. Berthelot has submitted both wood charcoal and coal to the reducing action of hydriodic acid, and among other results he claims to have obtained in this way oil of petroleum.—*Ibid.*

British Association of Gas Managers, June 14, 1871.

[Abstracts, by the Editor of this Journal.]

[Concluded from page 131.]

ON GAS MEASUREMENT.

By Mr. Hartley of Westminister.

Mr. H. Jones said he had found that the practice was prevalent of fixing meters too small for the consumption, which he regarded as bad policy on the part of the gas companies. For his own part, he never allowed anything under a 5-light meter to be fixed.

Mr. Phillips said he used wet meters entirely for public lamps, and did not have the least difficulty with them. In winter they were charged with a certain portion of methylated spirits, and he had never had one stop yet.

Mr. G. Anderson said it was clear that they ought not to allow meters to be fixed of a smaller capacity than is due to the number of lights to be used, but the difficulty was that if, say, a 5-light meter were fixed this year, next year the consumer would probably increase his lights to eight or ten. The consequence was that the water-line inside the meter was lowered, and the company did not get full pay for the gas supplied.

M. R. H. Jones, with reference to the periodical inspection of consumers meters, said in one of the towns supplied by his firm it was their custom to remove all the meters to the shop every other year, and having rinsed them well out, to put them under the test. In that town they had reduced the unaccounted for gas from 18 to below 10 per cent., and he believed it was mainly owing to this periodical inspection of the meters.

Mr. G. Parkinson said he was prepared to admit that Mr. Hartley's paper was exceedingly good, and in the majority of his remarks he entirely agreed, especially with reference to dry meters. It was an excellent idea of Mr. Hartley's to indicate the water-line of wet meters outside the meter—to indicate it at its working capacity; but, unfortunately for the satisfactory working of that plan, the water-line so adjusted was only correct so long as the friction of the meter remained the same as that at which it was adjusted. He (Mr. Parkinson) had had great experience with reference to meters to public lamps. On the first introduction by the Corporation of Birmingham of dry meters for that purpose, they were the cause of great annoyance. Some time back he took down 12 meters—the greater portion of them taken down at the suggestion of the borough surveyor—and out of the 12 there were only five within the limits of the Act. One was 16 per cent. slow, another 23 per cent. slow, another 23 per cent. slow, another 8, and another 8. The fixing of dry meters in the lamp-columns was a very severe test for them. It had been recently de-

termined by the Corporation of Birmingham to substitute wet for dry meters in the public lamps, and a plan similar to that employed by Mr. Hawksley at Nottingham had been adopted, and so far as it had gone the plan had worked very well—viz., that of fixing the meter in a box below ground. So great was the additional confidence felt both by the corporation and the gas company in wet over dry meters, that it had been agreed to extend the average principle to one meter in fifty lamps, instead of one in every twelve.

Mr. Hartley said he had to thank the members of the association most sincerely for the kind manner in which they had received his paper, and to assure them that the only end for which he had labored was to secure that which was right. As a meter-maker, he was willing and desirous that the instruments which he supplied should be subject to the severest test, asking only that those who used them should give them a like proportion of the attention which was given to other machines. In respect to a water gauge, or indicator, Mr. Lane suggested the use of a magnet and a needle. No doubt such an indicator could be applied, but it must be remembered that a meter must be of the character expressed by Mr. Warner in his paper of last year, "as delicate as the finest balance, yet rough as a grindstone." It was subject to all sorts of rough usage in carriage, fixing, and use, and it was, therefore, impossible for it to have any really delicate indicator, as the latter would certainly be liable to injury. With reference to public lamps, he was not prepared to assert whether wet or dry meters were the best, for he knew of cases in which both kinds had exhibited such variations in measurement as had been mentioned. The meters used by Mr. Hawksley had this one somewhat serious disadvantage, that they were very expensive—a disadvantage which was almost fatal to their application in many instances. It must be borne in mind that the quantity of gas recorded as consumed depended on the acting pressure at the burner and the size of the opening. It was true, in almost every case where meters were used for the public lamps, that regulators were also used; but regulators, like meters, were subject to some disarrangement, and wanted looking after. Here might part of the discrepancy in registration be sought, and another part, perhaps, in the unsoundness of the fittings. With regard to indices, he had specially referred to them because he felt that this was a vital point. Once in his experience he got into trouble through a workman putting a wrong index to a meter, and this had induced increased care; but he wanted to be protected from any chance of error. He had frequently found in old meters that the spindle-wheels had been changed by gas-fitters and others, and it generally happened that the maker was discredited. There ought to be some check. Mr. G. Parkinson remarked that the water line of a meter would vary with an increase of friction. Necessarily so. He (Mr. Parkinson) also remarked that the system suggested in the paper, with a view to secure uniform measurement, failed to indicate the true water-line. But surely it must be evident that, while the meter-wheel was free from corrosion or deposit, if the water level within it was kept at the same uniform height, the capacity must be uniform

Mr. G. Parkinson said theoretically the plan was perfectly correct, but in practice it was incorrect.

Mr. Hartley: The errors, if any, are very small.

Mr. G. Parkinson said unfortunately the errors were very extensive. He went through many experiments some years ago, when Messrs. Crossley and Goldsmith's meter, which was arranged on this plan, came into use, and ascertained the fact that inasmuch as the overflow of water was subject to the inlet pressure, on increasing the friction of the meter, by adding to the number of lights (the measuring capacity being only correct so long as the friction remained the same as when the adjustment was made), the meter varied from 2 to 15 per cent. fast. Another meter made by Mr. Clegg, in which the wheel was made to float, was subject to the same errors.

Mr. Hartley satd he also had made many experiments with Crossley and Goldsmith's meter, and Mr. Parkinson's observations were perfectly correct in respect to it; but it must be borne in mind that that meter was altogether different from the test meter exhibited, inasmuch as Crossley's meter had a square front and a compensating apparatus, which, while the meter was at work, continually supplied fresh portions of water to the measuring chambers, and this, and not friction, caused the meter to vary its registration. Meters like that exhibited, consisting of a measuring wheel within a simple cylinder, were not subject to such variations when used in the manner described in the paper.

Mr. G. Anderson read the following paper:

ON FUETHER EXPERIENCE OF TAR PAVEMENT.

In the conversation that arose on Mr. Methven's paper on "Tar Pavement," at our meeting last year, I stated that a considerable quantity of that kind of paving had been laid down at Dover; that we first laid all the paving at the new gas works there; that we next obtained leave of the corporation to do a portion of one of the public foot paths; that in the following year the corporation took up the matter themselves, employing the men that had done the work for us.

I have now the pleasure to state that the system has been continued up to the present time, and gives universal satisfaction.

Last year we disposed of some 30,000 gallons of tar for this purpose, and, to facilitate the preparation of the material, and render it harder when laid, we have prepared the tar by extracting from it the more volatile compounds, which is much appreciated, and will, no doubt, render the paving more enduring.

As a proof of the public appreciation of this kind of paving, I may state that, on one of the roads leading out of the town, the public had been in the habit of walking on the gravel footpath of one side of the road only; the footpath on the other side of the road was laid with tar paving for a considerable distance; the public crossed over from their former favorite path, and walked on the tar paving as far as it was laid, recrossing to the other side when it finished.

The paving has been done of all breadths, from 1 or 2 feet to 15 and 20 feet wide, and to the length of several miles, as may be judged from the quantity of tar used, as before stated.

Last winter was a very severe one, and well calculated to test its durability. I have since carefully examined the paving wherever I had occasion to walk on it, and I failed to discover a single defect.

The paving is also being employed as garden-paths to houses standing in their own grounds back from the public roads. It is also being used as pavement in the basement stories of houses; and, as one proof of the hold it already has of public opinion, I may state that one of the builders in the town has made it a branch of his profession, and weekly advertises in the Dover newspapers his desire to receive orders for this kind of work.

At the Dover workhouse many of the paths have been paved in this manner, and the master has reported a great saving of shoe-leather of the paupers; and he has advised that the younger children may now have much thinner shoes than formerly, and consequently more suited to their tender years, which will give them a more active gait, and assist in depauperizing them.

We have not been content with merely the footpaths being paved in this manner; we have represented to the town surveyor that the carriage ways should also be tar paved. We have shown him the paving at our own works, where horses and heavy traffic have been constantly passing over for the last three years, and we have succeeded so far as to try the experiment.

Early in the present year the corporation passed an order for 100 feet in length of the busiest street to be so paved.

The traffic has now been on it for some two months, but before it had been a week down the shopkeepers at each end were asking to have it extended opposite their houses, it being so smooth, so clean, and so noiseless.

At the present time a length is being laid down in another street to satisfy, I suppose, the representative in the council of that ward. Of course for the carriage ways, the *modus operandi* was somewhat different to that employed for the footpaths.

First, there were about 5 or 7 inches of tarred broken granite rolled down; next, the surface was covered with tarred granite chips, and these were rolled in, and the slightest inequality filled in; and, lastly, a coat of smaller tarred chips was rolled in to form the surface.

The town surveyor has several times reported most satisfactorily, and the surveyors from other towns in the country have been sent by their boards to inquire and report upon it.

I have now only to caution gas managers against supposing that all they have to do is to mix tar and stones together and lay them down. We have all made footpaths in this way—pehaps as long almost as there have been gas-works—and with very variable success.

I think the process is described in former transactions of this society; if not, those who wish to try it had better apply to some one who understands it, for success in this, as well as in most other things, depends upon the proper carrying out of details.

I may mention, also, that in several districts in London large quantities of this kind of paving were laid down last autumn. One road in Peckham I have observed, where the footways, about 20 feet wide, are so made. At several railway stations the platforms have been done in the same way, and I think I may say the system is likely to extend.

The sole object of this paper is to spread the information into districts where it may not be so well known, so that gas managers may, as we have done, get a sale for their tar, which is very often a drug and a nuisance, while local authorities are paying double what they need do for paving their streets.

Mr. D. Lane said that some public street pavements of this kind, executed under the superintendence of Mr. Still, at Cork, were, in his judgment, quite as good as the asphalt of Paris, and cost about one-sixth of the price. At first breeze was used with the tar, but was found not to make a sufficiently hard pavement, and ultimately clinkers from the furnace, ground under edge-runners, were employed. If laid down in dry weather, and properly levelled and sloped, nothing could be more satisfactory than this kind of pavement. It did not cost more than two shillings a square yard, whereas no flagging couldbe laid down in Cork for less than five shillings.

Mr. Broadhead said in Grimsby 10,000 yards of tar pavement were laid down in 1869, at 1s. 1d. per yard; in 1870, 9,000 yards at 1s.; and this year they had a contract for 4,000 yards at 1s., making a total of 23,000 yards in the last three years. The corporation was so well satisfied with this pavement that by annual instalments they intended thus to pave all the footways of the town.

Mr. R. H. Jones said the Corporation of Dover were providing funds at the rate of £500 or £600 a year to lay down tar pavement.

Mr. Miles asked whether it was necessary to erect expensive apparatus for distilling the tar; because, if so, it would be a serious drawback in the case of small gas-works.

Mr. Eldridge asked for information as to the *modus operandi* in constructing the pavement, and the general cost per yard.

Mr. G. Anderson said he went over a piece of the pavement at Cork, the other day, which had been down for five years, and found it in excellent condition, although the mode of laying it was not so good as was now adopted at Dover. As to apparatus, he might state that in his case it was used because he took the naphtha to some extent out of the tar, but it was not a necessary thing. Two years before, when the tar-paving was laid down on the works, this was not done, but they did that which greatly assisted the process of construction—heated the stones. The quantity of tar required was just as much as the stones would lick up, and therefore it depended upon the size of the stones.

The reading of papers and discussion was then brought to a close.

Report to the Board of Trade by the Gas Referees on the Ammonia Impurity in Gas.

[Condensed by Editor of this Journal.]

[Continued from page 134.]

The apparatus for delivering water to the scrubber is at least as important as the material with which the interior of the scrubber is filled. The best kind of distributing apparatus is one which by minutely dividing the water, and also wetting all parts of the scrubbing material equally, enables the purifying work to be done with the smallest amount of water. As a matter of economy, and also for perfect purification, it is desirable that there should be no pumping of the liquor back into the scrubbers—a process which can be dispensed with if one of the best kinds of scrubber is used.

In order that the scrubbers may be kept in an efficient condition, it is necessary that the gas, before entering them, be properly condensed and cooled. The condensers ought to be of adequate size and efficiency to allow of all the tarry vapor being eliminated from the gas, and drawn off into the tar-well, for, if this be not done, a portion of the tar is carried forward into the scrubbers, and is deposited there instead of in the condensers. The effect of this is doubly disadvantageous; firstly, by choking up the interstices in the coke or brick scrubbers, so that the gas, instead of ascending equally through all parts of those scrubbers, forces a passage upwards by a comparatively few routes, and thereby does not come in a proper manner in contact with the purifying water. The other disadvantage is that the gas, in such cases, encounters an unnecessary amount of resistance in passing through those scrubbers—producing an inconvenient amount of "back-pressure," which has to be overcome by the action of the exhausters, and also necessitating more frequent changes of the scrubbing material than would otherwise be required. Not less important is it to observe that, if the gas be not properly cooled in the condensers, the water in the scrubbers is raised above the ordinary temperature, whereby its power of absorbing ammonia is lessened; while at the same time the "liquor," after leaving the scrubbers, gives off into the air a larger portion of the ammonia with which it is charged than it would do at the ordinary temperature.

In gas works where the size or efficiency of the scrubbers is not adequate for the work required of them, their action is supplemented by the use of sulphate of iron, or of sawdust moistened with sulphuric

acid, either used separately, in small purifiers, or introduced on trays in the oxide of iron purifiers employed for the elimination of sulphur, This supplementary process, however, although effective for the removal of ammonia, is (or at least ought to be) only a makeshift, rendered necessary by a want of room for the erection of additional or of larger scrubbers, or else owing to a temporary increase in the make of gas to a greater extent than the scrubbers can cope with; for these supplementary processes yield less profit to the companies than is obtained when the ammonia-purification is effected solely by scrubbers.

The separation of ammonia from the gas is a most profitable process for the gas companies, and was adopted by them at first of their own accord, as a means of increasing their revenue. For example, let us suppose that thoroughly efficient scrubbers are used, *e.g.*, such as those at the works at Blackfriars. In those works there are five scrubbers, costing for construction £500 or £600 each, or less than £3,000 in all; but the value of the ammoniacal products obtained from these scrubbers is £3,000 per annum;* while the cost of labor per annum is virtually nothing; the scrubbers being self-acting, and the coke with which they are filled requiring to be changed (at the cost of about £10 for each scrubber) only once in two or three years. Hence it appears that with the very best kind of scrubbers, the cost of erection is repaid in a single year, and thereafter a large annual revenue is received from them. In this respect ammonia-purification stands in a different category from sulphur-purification, the processes of which constitute a pure outlay on the part of the gas companies.

Amount of Ammonia in Gas.

The quantity of ammonia contained in gas varies to some extent with the kind of coal used. A small portion of this ammonia is lost to the companies, and cannot be estimated, owing to its being drawn off with the tar from the hydraulic main and condensing pipes into the tar-well; and, as will be afterwards seen, another portion passes uncaught from the scrubbers, and is either wholly or partially absorbed by the moisture in the oxide of iron purifiers. But, with these trifling deductions, the quantity of ammonia contained in gas is ascertainable from the amount of ammoniacal products obtained by the companies from their purifying apparatus.

A table is given showing the ammoniacal liquor obtained per ton of coal in the different gas works. As at the Blackfriars works the whole of the ammonia is taken out of the gas, and also is eliminated almost entirely by the scrubbers in the form of ammoniacal liquor, the actual amount of ammonia may be calculated. At these works, twenty gallons of ammoniacal liquor of "10 ounces" strength† are obtained from each ton of coal, showing that the gas from each ton of coal contains about one-tenth of a per cent. of pure ammonia gas ($N H_3$)—in other words, one foot of $N H_3$ in every 1000 feet of gas.

A considerable proportion of the ammonia is eliminated from the gas in the condensing pipes, before reaching the scrubbers; and the more efficient the condensing process, the more easily is the work of ammonia-purification carried on in the scrubbers. At the Blackfriars works the condensers yield per ton of coal about nine gallons of six ounce liquor, and the scrubbers yield 11 gallons of 14 ounce strength; so that, in this case, one-third of the ammonia is taken out by the condensers and two-thirds by the scrubbers. But the ammoniacal liquor obtained from the condensers is too weak to be saleable; hence it has to be mixed with the stronger liquor obtained from the scrubbers. The requisite commercial strength of the "liquor" is about 10 ounces; if the liquor is much below that strength, it is objectionable from its bulk; and if it is much above that strength, it is likewise objectionable, as a saleable commodity, owing to its tendency to lose a portion of its ammonia by volatilization.

The "liquor" obtained from the condensers varies in strength from about four and a half to seven ounces—these variations being mainly due to the condition of the coal as delivered to the retorts; for the dryer the coal, the less aqueous vapor is contained in the gas, and accordingly the ammoniacal liquor formed in the condensers is less diluted than when coal is more or less damp.

The ammonia which remains in the gas after passing through the scrubbers at the Blackfriars works only amounts to two or three grains per 100 feet of gas. This residue is entirely eliminated from the gas by absorption in the moisture contained in the oxide of iron purifiers employed for the elimination of sulphur; but in this way it is lost to the companies. At the same time it is to be observed that in proportion as the amount of ammonia in the gas is reduced, the difficulty of catching it in the scrubbers becomes immensely increased. For example, in the excellent scrubbers employed at the Blackfriars works, where the coke is divided into three tiers or compartments each eight feet in depth, it is found that the lowest tier, which the gas first enters, yields *of itself* 11½ ounce liquor; the middle tier two ounce liquor; and the uppermost tier only half ounce liquor; in other words, of the total amount of ammonia eliminated by this scrubber (which yields 14 ounce liquor), the uppermost tier takes out only 3½ per cent. while the undermost takes out 82 per cent. Arguing from such facts, it is a common opinion in gas works that the more the water is impregnated with ammonia the more capable is it of absorbing ammonia—a notion, it is hardly necessary to say, wholly erroneous. The explanation of the fact which has given rise to this notion is evidently the very simple one, that the difficulty of catching ammonia (or any other substance) is immensely increased when the ammonia is greatly diluted, or, in other words, exists only in an infinitesimal quantity compared with the volume of gas in which it is contained; whereas when the water or "liquor" comes in contact with the unpurified gas, as it does in the lower part of the scrubber, the proportion of ammonia absorbed is very large.

Apparatus for Ammonia-Purification in the several Gas Works.

Under this head the referees give extensive tabular statements, for which it is impossible that we should make room.

In connection with this table they append the following remarks:

1. *Condensing Surface.*

The condensing surface includes not merely the superficial area of the condensers proper, but also of the whole length of pipes between the hydraulic main (which receives the gas directly from the retorts) and the scrubbers. We adopt this mode of statement because in some works there are no condensers proper—as at Beckton, where the condensing work is at present effected simply by a long range of pipes—and also because every yard of pipe between the retorts and the scrubbers exerts some power of condensing the gas.

The *extent* of the condensing surface, however, is no criterion of the actual degree to which the gas is cooled and cleansed from tar. The condensing power depends, of course, upon the degree to which the pipes are exposed to cooling influences; and the pipes may be either placed in water, or with water dripping upon them, or filled with coke (*i. e.*, dry scrubbers), or simply exposed to the air, or lastly (as at Beckton) kept mainly underground. It is disadvantageous to subject gas to a *sudden* cooling (one effect of which is to produce a deposit of naphthaline, choking up the subsequent pipes, and also withdrawing from the gas a portion of its light-giving elements); hence it is desirable that the condensing should be effected gradually, and as far as possible under uniform influences.

One of the most certain means of keeping the condensing action at a steady point is by placing the condensing pipes underground, where the temperature is more uniform than if the pipes were in air, exposed to the great vicissitudes not only of summer and winter, but also to the daily differences of temperature produced in the pipes by sunshine and cloud, and most of all by a summer shower, which by rapid evaporation produces an exceptionally great and sudden cooling of the gas. At the same time, as radiation proceeds very slowly in underground pipes—the surrounding soil retaining a large portion of the heat imparted to it by the gas in the pipes—the underground process of condensing requires an exceptionally large extent of pipe in order to be adequately effective. On the other hand, the underground process avoids the difficulty experienced in condensers proper, on hot sunny days, when the effect of the sunshine upon these open-air pipes may considerably *raise* the temperature of the gas, thereby nullifying to some extent the cooling already effected. This process also attains, to a greater degree than any other, the important object of keeping the tar for a long time in contact with the gas, whereby as large as possible a portion of the hydro-carbons (the light-giving elements) are retained in the gas, instead of being partly drawn off with the tar.

Another means of efficient condensing at a steady temperature is the process of placing the condensing pipes in a tank of water, arranged in channels, with the water flowing in an opposite direction to the gas in the pipes, the cool entering water coming in contact with the gas-pipes only at their outlet from the tank, and becoming gradually warmed in the subsequent channels in proportion as it reaches the other end of the tank, where the gas enters at a high temperature (about 120° F.) from the pipes in the retort house. This process is employed at the works of the South Metropolitan Company (in the old Kent Road), and the engineer, Mr. Livesey, states that he finds no difficulty in maintaining the water in the tank at nearly a uniform temperature, both in summer and winter. The temperature of the water is duly examined at intervals, and it is kept at a steady point by simply increasing or diminishing the admission of water, according as it is desired to lower or raise the temperature of the tank.*

This process has the advantage not only of affording means for neutralising the great variations in the external temperature, but also of adequately meeting the variations in the make of gas, simply by regulating the flow of water through the tank. The South Metropolitan Company have special facilities for the employment of this condensing process, for they have a right to the free use of the water in the adjoining canal. Nevertheless, the referees are of opinion that there is no obstacle to the adoption of the same process by any gas company. The only possible obstacle would be the cost of the water; but in every gas works the quantity of water in daily use is amply sufficient of itself to supply the condensing tank, if the water, or a portion of it, were delivered into the tank in the first place, and thereafter used for the ordinary purposes in the works.

At the Fulham works of the Imperial Company the engineer, Mr. Kirkham, relies mainly for condensing upon "dry scrubbers"—vessels of the same shape and size as ordinary scrubbers, and filled with coke, but with no water passing through them. This kind of condensing apparatus has some special and important advantages. It allows of a more ready *settling* of the tar, and it also tends to separate the tar from the gas by friction, through contact with solid material. On entering one of those "dry scrubbers"—the interstitial area of which, when the coke is unfouled, is much larger than the area of the entering pipes, the velocity of the gas is greatly reduced; and, in consequence, the tar, which is suspended in the gas, tends to settle, very much in the same way as the mud which is easily carried on by a rapid stream is deposited on entering a pool. But the process of depositon is increased, in these "dry scrubbers," by the gas coming at all points in contact with surfaces which promote such a deposit; the tar, in fact, is as it were "combed out" of the gas by having to pass through the network of coke with which this condensing apparatus is filled."

* We are unable to see how this plan differs from the Sabbaton multitubular condenser, used by many of our largest American companies.—Ed.

* The coal carbonized at the Blackfriars Works in 1870 was 63,494 tons, each ton yielding 20 gallons of ammoniacal liquor of 10 ounce strength—the present selling price of the liquor being 5s. 2d. per butt of 108 gallons.

† "Ten ounce liquor" means ammoniacal liquor of such a strength that 10 ounces of sulphuric acid, sp. gr. 1·845, are required to neutralize a gallon of it.

Notes on Photometry.

By William Foster.

One of the Gas Examiners to the Metropolitan Board of Works.

It occasionally happens that three or four experiments made at regular intervals during two hours of any one evening agree so closely that the gas appears to be of the same value each time an experiment is made. The very reverse, however, sometimes occurs, the numbers representing the illuminating power of the gas during the evening differing to the extent of two candles. The readiest explanation of such results as the latter is, that gas of varying quality has been passing through the main at different periods of the evening; and such a view of the case appears to be the only feasible one, when the experiments are known to have been made under similar conditions. By similar conditions it is implied that the gas has the same temperature, and is passing through the meter at a uniform rate, the barometer stationary, and the candles burning the same amount of sperm, or about the same, in each experiment. The first three conditions are obviously necessary. The latter does not at first sight appear to be so, owing to the correction made at the end of each experiment for any variability in the rate of consumption of the sperm. For most practical purposes, this correction for different rates of consumption of the sperm is sufficient—that is, when the candles are burning about the standard quantity. Still it is desirable to restrict its application within as narrow a limit as possible. The instructions of the gas referees are, that each experiment shall occupy ten minutes, and that the two candles employed shall consume 40 grains of sperm (120 grains per hour). These conditions are rarely if ever fulfilled; and it is to wide variations from this standard that my remarks are especially applicable. I have long ago questioned the value of observations taken with candles burning at low rates—say from 33 to 35 grains, and sometimes have not recorded them. The method adopted for arriving at a corrected result is to multiply the sum of the ten photometrical readings taken during the ten minutes by the number of grains of sperm consumed, and to divide this product by two, since two candles are used in the experiment. This process involves the theory that the light emitted from sperm is in simple proportion to the quantity consumed. For instance, *cæteris paribus*, the photometrical readings, based on the law that the intensity of lights is in the proportion of the squares of their dis-

tances from the point of measurement, are inversely as the consumption of the sperm. In other words, that any deficiency in the amount of sperm consumed is compensated by a higher reading in the photometer, and *vice versa*, so that the product obtained by the multiplication of the readings and the quantity of sperm consumed fairly represents the quality of the gas. This does not appear to me to be exactly true, at least not so far as ordinary practice is concerned. During last winter I had a parcel of candles, many of which gave not only low rates of consumption, but also very variable ones. Some of my results at that time were very high; and since then I have incidentally noticed that a low rate of consumption of sperm is in the majority of cases attended with a high number representing the illuminating power of the gas. In order to speak with confidence on this point, a large number of experiments have been made, the majority of which bear out all that I had previously noticed. They were made on consecutive evenings, extending over a week, and one experiment followed the other as quickly as circumstances would permit, the object being to notice whether any difference in the quality of the gas could be detected in such short intervals, when the conditions of the experiment were the same. The following were taken on three succeeding evenings, the same pair of candles being used for all the experiments made on any one evening. The method pursued was slightly different from that recommended by the referees, and was as follows:

During the time that the candles were burning in order to be ready for the first experiment, the quantity of gas was adjusted by the meter clock being used only for that purpose. Having the candles burning at the required rate, they were then placed in a balance, and, when the turning-point was reached, a clock was immediately started by the right hand. A 40-grain weight was then placed in the balance on the side of the candles, the whole removed to the photometer, and the observations taken in the prescribed time. Towards the end of the ten minutes the candles were taken out of the photometer, placed on the balance, and the moment that the turning-point was again reached, the clock on the right was instantly stopped. The time which had been required to consume 40 grains of sperm was then noted, and from this was calculated the consumption in 10 minutes. Thus, suppose 625 seconds have been required to burn 40 grains of sperm, then $625 : 40 :: 600 : x$. x=the consumption of sperm in 600 seconds (10 minutes), in grains. This method in theory is the true one, the object being to weigh the candles on the two occasions under the same conditions so far as currents are concerned. Apart from this consideration, it has two special recommendations; there is no danger of losing any particles as there is when the candles are blown out, and in the second place the candles are immediately ready for another experiment, The experiments here given were made at a time when the pressure in the main was extremely regular, so much so that, having once obtained the gas passing at the required rate, scarcely any further adjustment was necessary.

July 6, 1871.

Time when an Experiment was commenced.	Sperm Consumed in 10 minutes.	Illumin'g Power in Candles.
8.25 p. m.	40·0	16·16
8.40 "	40·0	16·26
8.55 "	40·9	16·38
9.5 "	36·6	17.00
9.80 "	36·3	11·28
9.50 "	42·1	15·45

July 7, 1871.

8 25 p. m.	36·6	17·00
8.50 "	42·9	14·69
9.40 "	36·7	16·90
9.55 "	37·3	15·85

July 8, 1871

8.30 p. m.	37·4	16·79
8.50 "	36·1	17·03
0.7 "	44·8	15·90
9.20 "	37·5	16·81
9.35 "	40·8	16·07
9.50 "	40·0	16·88

Experiments are not wanting which, at first sight, would appear to upset what these now given are intended to show; but such are not numerous. Besides, it must be borne in mind that throughout the whole there was the possibility of a difference in the quality of the gas. Hence the necessity of making a large number of experiments before any satisfactory conclusion could be arrived at. These results may be objected to on the ground that the use of the same candles for showing the effect of different rates of consumption is faulty at the outset, simply because the wicks are not adapted for such varying quantities. I may add that my experience is, that candles will of themselves vary to the extent of several grains. The candles here used were trimmed in order to obtain the different rates, but in no case could I detect anything objectionable in the character of the flame—they did not smoke. These results practically show that the tendency is to report gas above the truth when the rates of consumption are low; or that the amount of light emitted by sperm when burnt in the ordinary way is not simply proportional to the amount consumed, but that it is proportional *plus* a certain quantity. I regret that I have not the means of storing gas of uniform quality, so as to be able by further experiments to arrive at some satisfactory numbers showing the law which regulates this increment to the illuminating power.

The photometer used is that known as Evans's improved form of the Bunsen. It is a rectangular box, 112 inches long, 6·5 inches broad, and about 11·5 inches high. The whole of the interior is lined with black velvet, except the greater portion of the roof, which is rounded, and made of blackened sheet copper. Midway in this box is a fixed diaphragm containing the waxed disc. The box is thus divided into two chambers of equal size, the capacity of one of them being about 4200 cubic inches. In one of these chambers, 50 inches distant from the waxed disc, is a fixed burner for the gas to be tested. In the other box is a sliding support for the candles, this support carrying an indicator which moves along a graduated scale on the outside of the machine. Each chamber is provided with a large door at the side. When an experiment is being conducted, the two chambers are closed during the entire time. The 40 grains of sperm burnt in 10 minutes require 126·2 grains of oxygen from external sources in order to convert the carbon and hydrogen into carbonic acid (carbonic anhydride) and water. The amount of atmospheric air containing this quantity of oxygen is 1768 cubic inches, or nearly one-half the amount contained by the chamber in which the candles are placed. In addition to this a large quantity of air is always carried along with the spent vapors, by virtue of the current which they establish. Now what are the precautions taken for the supply of air, and the exit of the products of combustion and rarefied atmospheric air? Along the whole length of the under part of the machine is a narrow slit from 3-16ths to 4-16ths of an inch in breadth. Air cannot pass into the photometer through this slit without passing twice at right angles, thus avoiding all danger from draughts. This source of air is the only intentional one, and I imagine is sufficient to meet the requirements of both the gas and the candles. It is the means of exit of the heated vapors that appear to me to be faulty. Every one accustomed to the use of the instrument must have noticed that nearly every time an experiment is made the numerical value of the photometrical readings gradually increases. This increase is such that where the first readings may be 8 the probability is that the 10th will be 9, or 9·5. This ought not to be, as it indicates that the candles do not give the same amount of light towards the end of an experiment that they do at the commencement. It is quite manifest that the gas does not suffer, at least to the same extent, as the candles, otherwise the increasing value of the readings would not occur. My opinion is that the gas is tested under more uniform conditions than the candles, and for this reason. Immediately above the Argand burner is a copper chimney, which at once takes away the heated gases and rarefied air, causing a proportionate influx of cold air through the slit below. The chamber containing the candles is also provided with a similar chimney, equally distant from the waxed disc—namely 50 inches. The two chimneys, placed as described, not only maintain the symmetrical proportions of the instrument, but, if required, also permit two kinds of gas to be tested in it by burning one at each end. In addition to the two chimneys, one in each chamber, the eaves—so to speak—of the arched copper roof along their entire length admit of the exit of the heated vapors. The two slits, one on each side, are more complicated than the one at the bottom which supplies the air, and consequently the products of combustion of the candles have to pass by a very circuitous route before they can escape. There can be no question that the chimney placed above the gas flame permits all the impurities to escape at once. The case of the candles is different. When testing 16-candle gas the two candles are then more than 30 inches distant from the chimney, so that its use for the purpose of ventilation is *nil*, or nearly so. The spent vapors and heated air must then escape promiscuously through the slits along the two edges of the roof, which appear to be insufficient for the purpose. At first I was led to suppose that the increased value of the readings was due to an imperfect supply of atmospheric oxygen, owing to the narrowness of the slit supplying the air. But such a view is no longer tenable when one reflects that the supply to a flame eight times the size takes place through the same sized opening, without any apparent deterioration in the value of the flame. And yet there can be no doubt that it is owing to an imperfect supply of oxygen, although caused somewhat differently. The ingress of air is determined by the egress of the heated vrpors, so that increasing opportunities of escape for the latter is simply causing a greater supply of the farmer. It therefore appears to me highly desirable that some form of chimney should be placed over the burning candles, so that they may be under conditions similar to those under which the gas is being tested in the adjoining chamber. If this chimney were constructed with a movable diaphragm, the draught would then be under control. As the instrument is at present worked, the candles are so near the roof that the need of this addition is shown by its very high temperature after the candles have been under it not more than ten minutes.—*Chemical News.*

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—EDS.

On Portable Gas Machines.

BRIDGETON, N. J., October 31, 1871.

Mr. Editor: I would be glad to have your opinion in reference to a portable gas machine, which a man by the name of Howard Tilden claims to have taken out a patent for in 1869, and which he has been selling the right to manufacture and use in our city and county. If anything of the kind has ever been described in your Journal it has escaped my notice.

I will endeavor to give you a brief description of the one now in use in one of our drug stores, the bills for lighting which, heretofore, at this season of the year, has been from $10 to $12 per month; and they say with their patent gas they can light the same for less than $2 per month; which, if one half be true, as you perceive, must blow us old-fogy gas-companies *high* and *dry*.

The apparatus which I saw consists of an oil barrel with one head taken out, and filled, say two-thirds full, with water, into which is put about two gallons of sulphuric acid. From the bottom of the barrel rises a pedestal, upon which rests a perforated pan, in which is placed 25 pounds of iron borings; over this is turned a copper cylinder, somewhat resembling a small gasholder, which is secured at the top by a cross bar, and is thus made stationary. The action of the sulphuric acid upon the iron borings generates a gas which fills the upper part of the cylinder, and passes off through a pipe, in which is placed a stop cock, to shut it off when required: from thence it passes into a funnel-shaped tin can, containing about one gallon of oil, in passing through which it absorbs or takes up a sufficient quantity of the oil to render it tolerable fair illuminating gas. A casual observer would not, perhaps, notice the difference between this and ordinary gas, except that it flickers worse.

Now, if illuminating gas can be produced so cheap, and by so simple a machine as this, the whole cost of which, I suppose, would not exceed $20, why is it that the world has not resounded with the praise of this wonderful machine? I send you a rough diagram, which will perhaps assist you in understanding its construction.

Please give me your opinion of gas thus generated, and what effect it would be likely to have upon pipes, fixtures, burners, etc., and oblige

Yours most respectfully,

U. D. WOODRUFF.

INFLUENCE OF LIGHT ON PETROLEUM.—According to recent researches, petroleum, when exposed to solar light, absorbs oxygen and changes it into ozone, although this does not combine with the oil, the ozone remaining free, and oxidising everything with which it comes in contact. Petroleum oils impregnated with ozone have a totally altered smell, burn with more difficulty, and attack the cork stoppers of the vessels very strongly. If the vessels are of glass, their color exercises much influence upon the absorption of oxygen by the petroleum. Thus, petroleum oils, when exposed in white glass to solar and daylight, become yellow and impregnated with ozone, assuming a greater specific gravity, and losing their ready combustibility. This is said to be especially the case with American petroleums. The practical inference may therefore be deduced that petroleum intended for burning should be kept in stone or metal vessels; or, if in glass, protected as much as possible against the influence of daylight.—*Ironmonger.*

The Coal Supply of England.

The London *Mining Journal* fights against fate as follows:

It has been taken for granted that the decline of England's greatness will date from the time when she ceases to be able to produce an almost unlimited quantity of coal, and the probable time is given when we shall be in that position, assuming that the increase will go on in the same ratio it has done during the last few years. But, before coming to such a conclusion, are there not many matters to be taken into consideration? Will Science stand still, and the genius of mechanism be altogether stayed for the next three or four hundred years? or is it an absolute fact that coal will not be worked at a much greater depth than 4000 feet? Now, there is no doubt even at the present time there is every appearance that some new motive power will be introduced capable of greatly lessening the demand for coal. Indeed, it is even now said that fluid gas of ammonia, when subjected to a heat of 60° Fahr., turns into a vapor which produces a pressure of 60 lbs. to the square inch. At the present time also, at some of the collieries at Yorkshire, coal is being got by machinery, the motive power being compressed air. According to Mr. Hurd, of Wakefield, who is now extensively engaged in the production of air-compressing machinery, 5 lbs. of steam will produce something like 20 lbs. power of compressed air. Here, then, is the means for effecting a very large saving in fuel, were such necessary. But there is apparently no necessity for economy, and in nearly all parts of the kingdom collieries are being opened out, and new customers are being sought for in all directions.

As to the limit of 4000 feet, when it is assumed that the temperature in a coal mine at such a depth would be something like 120°, it does not follow that means for ventilating at greater depths will not be found out. At the present time the deepest mine in the kingdom is the Rosebridge, near to Wigan, which is 2,340 feet deep, whilst the colliery Des Viviers, near Charleroi, is 2,820 feet deep; and another one in the same district has been sunk to more than 3,400 feet in depth. No doubt at those great depths the density of the coal increases, but not to such an extent as to prove beyond the power of manual skill or mechanical contrivance to work. In working some of the coal machines at present in use it has been found that with the air at a pressure of 45 lbs. to the square inch the reduction in the temperature in the neighborhood of the machine was fully 5°, and this could be increased considerably. The air that came from the machine, unlike the ordinary air in a mine, which had to traverse a long length of passages, was brought pure and fresh from above ground. That the limit of 4,000 feet will, therefore, be exceeded, and that very considerably, may be safely inferred, not only from the above facts relating to ventilation, which is the great essential in mining operations, but from what may be expected from the progress of science and mechanical genius. In 40 years we have increased our locomotive power from 10 miles an hour to over 60, and there is no halting place for science, for it may be said that the end of it will never be reached.

Were it necessary many proofs could be adduced showing even at the present time that there are many appliances which could be substituted for coal, and no doubt will ultimately be adopted. In London alone the quantity of coal required for gas making purposes is more than 1,000,000 tons annually, full one-sixth of all that is imported by rail and water. Now, who shall say that the electric light will not be substituted for that of ordinary gas? Does not the magnesium wire produce a light of extraordinary brilliancy, and is there not petroleum capable of being utilized for almost any purpose instead of coal? Therefore, in one way alone, in gas, fully one-seventh of all the coal raised could be saved if necessary, and probably will be.

Another point is worthy of consideration, and indeed is all-important—that is, is it at all probable that the consumption of coal will increase at the rate it has done? About one-tenth of all the coal raised is exported, but for some years it has been almost stationary; for whilst we sent away, in 1867, 10,566,829 tons, in 1868 it had only increased to 10,967,062 tons, and had fallen in 1869 to 10,744,945 tons. The increase in the consumption during the last three years, it is apparent, was owing to the home consumption and the improvement in our manufactures, and the increased production of pig-iron.

But, going a little further, we may state that our future prosperity does not depend so much on our being able to maintain our coal producing power to an almost unlimited extent as many persons might be led to suppose. When the matter was mooted in Parliament, before the appointing of the Commission, Mr. Samuelson stated that whilst in 1865 about 30,000,000 tons of coal were used in the production of articles of which we exported to foreign countries only to the value of £9,000,000: but 3,000,000 tons of coal were used in the manufacture of textile fabrics, and of which we exported to the value of £96,000,000.

With the above facts in view there does not appear to be much room for fear as to the future of England, or that her downfall as a great nation, owing to the exhaustion of those products which so much contributed to her greatness, can be measured by hundreds of years. Her natural position, the industry, energy, and scientific attainments of her people, and, in all probability, the vast resources as yet undiscovered, will place her in the van of civilization for long ages to come.

[Apropos to the above, will be a few sentences, quoted, as follows, from the *Am. Chemist*:]

"The following estimate will prove interesting: Area of coal fields of carboniferous age within the limits of the United States 150,000 square miles. Productive coal area of Ohio is not less than 10,000 square miles or quite equal to that possessed by Great Britain, and far in excess of that of any other European nation. Annual coal production of Great Britain is now more than 100,000,000 tons. About 20,000,000 tons are devoted to the development of motive power which is equivalent to the labor of 133,000,000 men."

Picric Acid.

A COAL TAR PRODUCT USED AS A SUBSTITUTE FOR DYE-STUFF, QUININE, GUNPOWDER, AND HOPS.

Picric acid, otherwise called trinitrophenic, or carbazotic acid, is one of the most remarkable substances produced by the modern chemist, Formerly some peculiar compounds were obtained by the action of nitric acid and heat on indigo, aloes, salicine, etc.; but they were not especially investigated until it was proved that they were all identical with a compound more recently produced by the distillation of nitric acid with that now well-known product of coal-tar, the carbolic acid, more properly called phenyl alcohol. (Chemists prefer this name for it, since it acts more like an alcohol than an acid.)

Phenyl alcohol is a creosote, made from coal-tar, as the ordinary creosote is made from wood-tar. From it the so-called nitro-phenol is produced, and from this again, picric acid.

This substance is now extensively used as a dye-stuff for silk and wool, to which it gives an intense yellow color. For this purpose the mordant previously employed must be alum and carbonate of potassa. The picric acid forms then a very permanent tint, which no washing can remove or bleach. It is so intense a color that one pound of silk requires only from six to sixty grains of picric acid, according to the shade desired. This makes it one of the most economical yellow dye-stuffs. A neutral picrate salt gives with a neutral indigo solution a beautiful green.

Being bitter, like gentianine or quinine, it was supposed to be a tonic, and has been used as such, with a certain degree of success, in doses of small fractions of a grain, as a remedy against intermittent fevers.

When heated, picric acid melts, and finally explodes violently. Its compounds, however, chiefly those with alkalies, require less heat to explode. Some of them detonate, like nitro-glycerine, even by mere percussion, and offer for this reason a promising field of research for those modern chemists who busy themselves to promote the warlike and destructive tendencies of this age.

Picric acid being intensely bitter, as above remarked, (*pikros*, in Greek, means bitter,) it has been used as a substitute for hops in beer, and is for the manufacturer a very profitable adulteration, as only the small quantity of a single grain for every eight gallons is amply sufficient to give the desired bitterness of the hops. As it also at the same time possesses intoxicating qualities, it is a remedy for a deficiency of alcohol in the beer, in so far, namely, as some persons like their beer to have such qualities. However, in overdoses, it is decidedly poisonous. Experiments have proved that large dogs may be killed with one to ten grains of this picric acid, becoming first insensible, and then dying in convulsions.

Some time ago, an article went the rounds of the daily press, asserting that sparkling champagne wine was made from the benzine of petroleum. Since this benzine is a product in which the elements are not so combined as to allow the chemist to make a transformation of this kind, such a report is all nonsense.

In the picric acid, as used in beer, however, we have the second example of a coal-tar (not petroleum) product furnishing an ingredient of human food or drink. The first example of this kind was the so-called oil of Mirbane, an artificial oil of bitter almonds, also a product of coal-tar, and now not only extensively used as a perfume, and as an ingredient of the so-called almond soap, but also sold, highly diluted, by grocers as a flavoring extract, under the name of extract of bitter almond, and employed in our kitchens to flavor puddings, jellies, etc.—*Manufacturer and Builder.*

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

October 16, 1871.

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Albertite of New Brunswick	$16 00	@	17 0
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THE AMERICAN

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BROOKLINE, June 17, 1871.

E. DUFFEE, ESQ.:

Dear Sir: You will please make a set of Gas Trays for this Company as soon as convenient, at price named.

In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country.

Respectfully Yours,
H. A. ALLYN,
Superintendent Brookline Gas-Light Co.

EAST BOSTON, June 15, 1871.

Gentlemen: We have used your Screens some five years they give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen.

Yours truly,
A. M. NORTON,
Supt. East Boston Gas-Light Co.

CHELSEA, May 1, 1871.

MR. E. DUFFEE:

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly,
JOHN ANDREW, Supt.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ:

Dear Sir: The Trays ordered by this Company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige. Yours truly,
JAMES F. ROGERS,
Supt. Jamaica Plains Gas-Light Co.

Also see letter from Providence, R. I., in another column.

It will be for the interest of all Gas-Light Companies needing new Trays another season, to give their orders early, to be delivered where wanted, as we were unable to fill orders promptly to Companies ordering late last fall.

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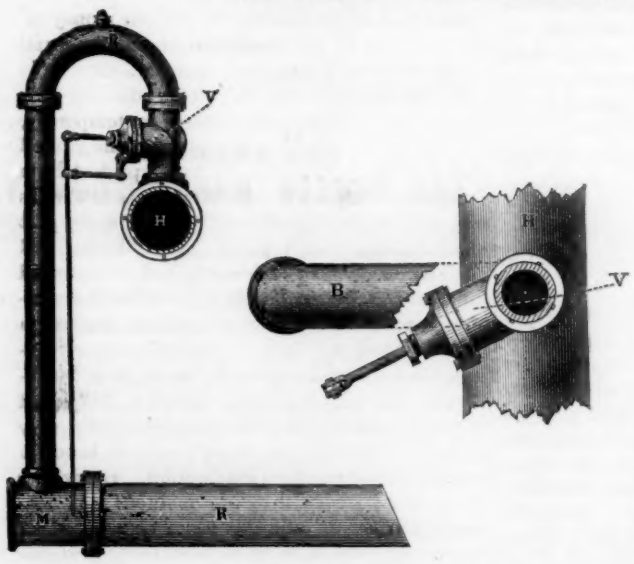

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THURSDAY, NOVEMBER 16, 1871.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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General Editorials.

BUILDING MATERIALS.

The Chicago conflagration has of course brought up this subject very prominently. It seems therefore a proper time again to urge our views regarding a true and reliable material for all structures which are to be inhabited by human beings, including ships and railway cars. This, we have repeatedly stated, is wood thoroughly impregnated with solutions of deliquescent chlorides, like chlorides of calcium, magnesium and aluminum.

Iron, as we have long predicted would occur, is fast losing all its prestige, for buildings in cities at least. Its supposed *fire-proof* reputation must have received its quietus at last from the Chicago calamity. For railway cars, as well as dwelling-houses, it must be in winter the coldest and in summer the hottest material that can be devised. We are glad to see that our esteemed contemporary, the *American Artisan*, in his last issue, adopts this view, stating also that the want of elasticity is found to be another great objection to iron, for rail cars. We also learn from him that on the Hudson River Railroad the iron freight cars are about 25 per cent. *heavier* than wooden ones, thus knocking out the bottom of another prevalent fallacy. We cannot stop to discuss the popular delusions that have been so prevalent regarding the fire-proof qualities of marbles, granites, sandstones, etc., in face of the familiar fact of the crumbling of all these to powder by the application of water to them while hot; bnt must pass on to the consideration of the immense advantages presented by wood prepared in the proposed way. Such wood may not be absolutely "fire-proof" (a quality in fact never absolute, but only relative), except inasmuch as it will not *propagate* fire; and a town built entirely, or even mostly of it, would be more fire-proof, in every practical sense, than the Palisades, or the Central Park Reservoir. Even a street, of houses built of it, could not be damaged except at its ends. It will not kindle of itself, though it may be *roasted* by intense external heat and made to give off gases which will kindle. A railway car made of it could *not* be injured, unless it was thrown into a fire, an improbable contingency. The strength of such prepared wood is not impaired, while its flexibility and elasticity are greatly increased, an approximation to whalebone or horn in these respects being effected. A car or a vessel built of it, could no more be "knocked into splinters," to deal around wounds and death, than one of wrought iron. Such wood ranks very high as a non-conductor of heat, and would make structures cooler in summer and warmer in winter than any other cheap or suitable material that could be devised. I may add that its sonorosity (or capability of conveying sound) is almost destroyed, a high recommendation for doors and partitions. One of its highest qualifications is that it will never change its bulk, or volume, being *seasoned* to the last extremity. By simple and almost costless devices of the writer, it is readily protected from external moisture, so as even to be adaptable, in the majority of cases, to out-door work; though it is not pretended of course that it will stand such exposure without protection. The same devices render it susceptible of every kind of ornamentation, by painting, varnishing, etc., etc. For dry rot, insects or other parasites, it will prove very poor pabulum. To the *teredo* we do not insist that it shall be subjected, though we believe that even for this *bete noir* it will prove a very hard nut to crack.

With regard to cost, this will no doubt be a little greater than that of ordinary timber, though a part of the increase otherwise, will be compensated by the saving of the time and space occupied in ordinary seasoning. The injurious action that has been alleged, on steel tools, is averted by another invention of the writer. Such wood is increased in weight, but not in greater proportion than in the substitution of iron for ordinary timber.

More may be said, but this is enough for our present object. That it may be believed that the present writer is qualified to bear testimony on this head, he will add that some years ago he spent many thousand dollars and two years time in elaborating and demonstrating these things practically, being highly impressed with the greatness of the boon that would be conferred on mankind by reviving and perfecting these forgotten ideas of Boucherie and others. It is unnecessary to say that he has been disappointed, having found that in this country of ours, notwithstanding the self-adulation we pile up so monstrously, about our intelligence and enterprise, we are torpid and indifferent to an extraordinary degree about inventions belonging to the chemical class. This is a mental disease of our American people, which is going to require much medicament of hard words, and even hard knocks (like this at Chicago) to expel. Chemical inventions are tinctured too much with *Science*, which is "visionary," and which at least "we don't understand"; and, as we know that profit *is* made out of inventions, we put our money rather into patent inkstands and cornshellers, and things which are within our capacity.

We close with a reference to an editorial article in a recent issue of another contemporary, the *Scientific American*, which takes the the ground that the only agent that can really protect from fire for any length of time is *water;* and throws out, as a "hint to inventors," that if every part of a building, "each pillar, block. lintel, and sill" could be filled with water, and "converted into a steam boiler, evaporating water at atmospheric pressure" and so on, perfect protection would ensue, and that "it would be clearly impossible to burn a city made up of such buildings." We ask our *confrere* whether this is not precisely what *we* want to introduce, not merely in a suggestive way, but as an invention brought to the point of practical application. Every pore of the wood prepared by our methods is permanently filled with a liquid, largely composed of water, and even much more resistant to evaporation by heat than water itself.

SCIENCE AND EXPERIENCE.

There is an old saw, old enough, and false enough withal, to have passed into desuetude—a fate that, however, never overtakes these ancient popular fallacies, simply for the reason that it is the interest of the vast majority of men to perpetuate them—which avers the latter of the above possessions to be preferable to the former. So many and so strong, particularly in America, are the adherents of this particular fallacy, that the possession of Science is considered a demerit, even when conjoined with experience; and the dictates of an individual having both, are valued below those of the "practical man" who has nothing but experience.

Cases very often occur, however, where scientists are enabled to point out that they have predicted, by deduction from general principles, results, in the way both of successes and of failures, that have been afterwards remarkably verified by expensive, sometimes dangerous experi-

nce. Our exchanges of recent date furnish an example of this, in our own case, to which, while not attaching an overweening importance thereto, we think it just to ourselves that we should call the attention of our readers. The item we refer to is as follows:

"ON DYNAMITE, BY P. GUYOT.—The substance known as dynamite (consisting essentially of nitroglycerine absorbed by any suitable inert powder) is met with in the trade made up in cartridges weighing, on an average, 71 grms., and packed in boxes weighing, with contents, about from 25 to 30 kilos. The author, happening to have in his possession a number of cartridges containing dynamite (the body of the cartridge is made of stout grey paper), found that these objects, after some lapse of time, became moist and oily looking, and a cardboard box in which the cartridges were kept was also found impregnated with a liquid, which, on investigation, turned out to be nitroglycerine. A small piece of the paper so impregnated exploded violently when brought into contact with glowing coals, and the like effect was observed when a piece of the paper was laid upon an anvil and smartly struck with a hammer. The author also found that the wood of the boxes in which the dynamite cartridges are kept becomes, by slow degrees, impregnated with nitroglocerine, and thereby a most dangerously explosive material, which may give rise to serious accidents in warehouses where dynamite is kept."

And in juxtaposition with this we desire to reproduce the following remarks of the present writer, just three years since (in the issue of November 2, 1868, page 137), under the heading of "Dynamite."

"As, however, even from tempered clay, containing anything like three-fourths, or even half of its bulk of water, the latter would in time partially separate in a closed vessel; and especially as in nitroglycerine we have a material like *oils*, like petroleum for example, which has in a high degree the propensity popularly called "soakage," and that of expanding and creeping over surfaces; I do not see but that further light is necessary to inspire much confidenoe in these new devices."

HYDROGEN NAPHTHALIZERS.

In reply to Mr. Woodruff, of Bridgeton, N. J., in our correspondence to-day, we must be briefer than we could wish. The general system, of which Mr. W. describes one of the simplest forms, is very familiar to us. As long ago as March 7th, 1844, there is an English patent to Croll & Richards, for "mixing together zinc, water, oil of vitriol and naphtha, or other volatile combustible liquid, to obtain hodrogen gas impregnated with the vapor of the hydrocarbon, for illuminating purposes."

It will be observed that this arrangement is still simpler. January 15, 1856, an American patent to Davis & Cunningham, covers a similar plan. Of late years many attempts have been made to revive the system in different shapes. Mr. Woodruff will find, for instance, the apparatus of Dunderdale, figured on the first page of our issue of July 16, 1869. We wish we could discuss this whole subject in all its bearings, as regards economy, effect on pipes, and so on, but can at this time only give our reply to Mr. W.'s emphatic question, "Why the world has not resounded with its praise, etc."; and this by another question of our own, to which we shall give our reply. We all know how much cheaper petroleum lamps are than gas. Why do we not all use them? Our reply is in one word—*convenience*. This is an advantage most people will pay for, like any other advantage. So that IF (a capital if too) the economy *is* as great as "they say" in "one of our drug stores," Mr. W. need not, we think, be very much startled.

GAS WELLS.

The Editor of this Journal, at this present writing is upon the programme for a communication on the above subject, to the Society of Practical Engineering, on the evening of Nov. 15th; which communication will have been made by the time this reaches the public. His endeavor will be to convey some adequate ideas of the wonderful work which is foreshadowed in the future, for the engineers and practical men, as well as the geologists, of this and probably other lands, in connection with developing, confining, conveying, utilizing and manipulating these natural fountains of power. In the next issue these matters will probably be entered into in a manner more extended and systematic than at any time hitherto.

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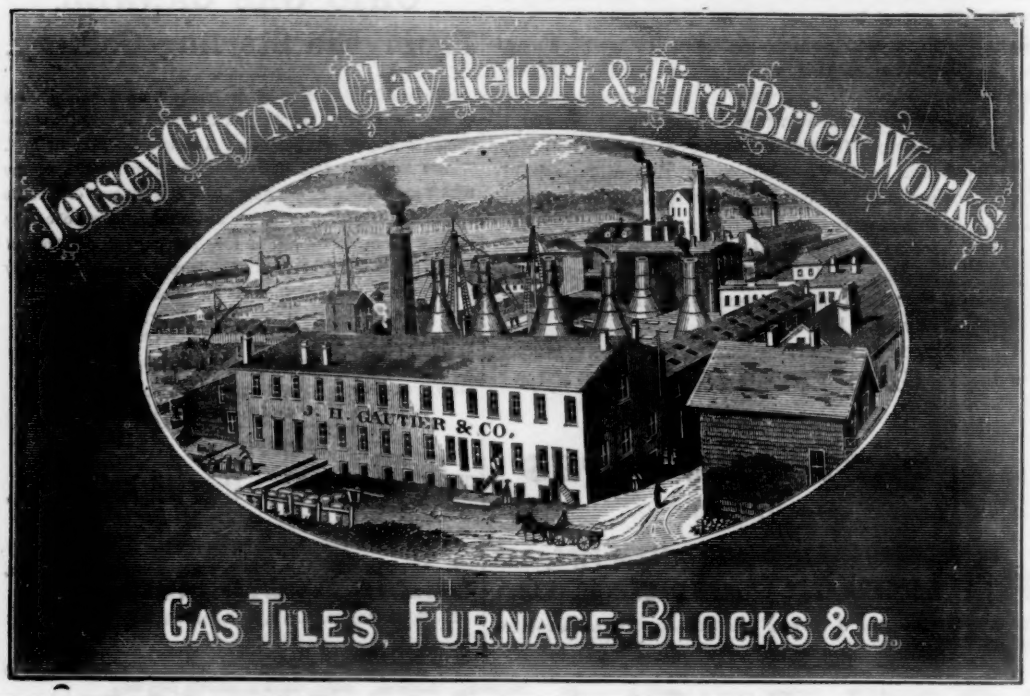

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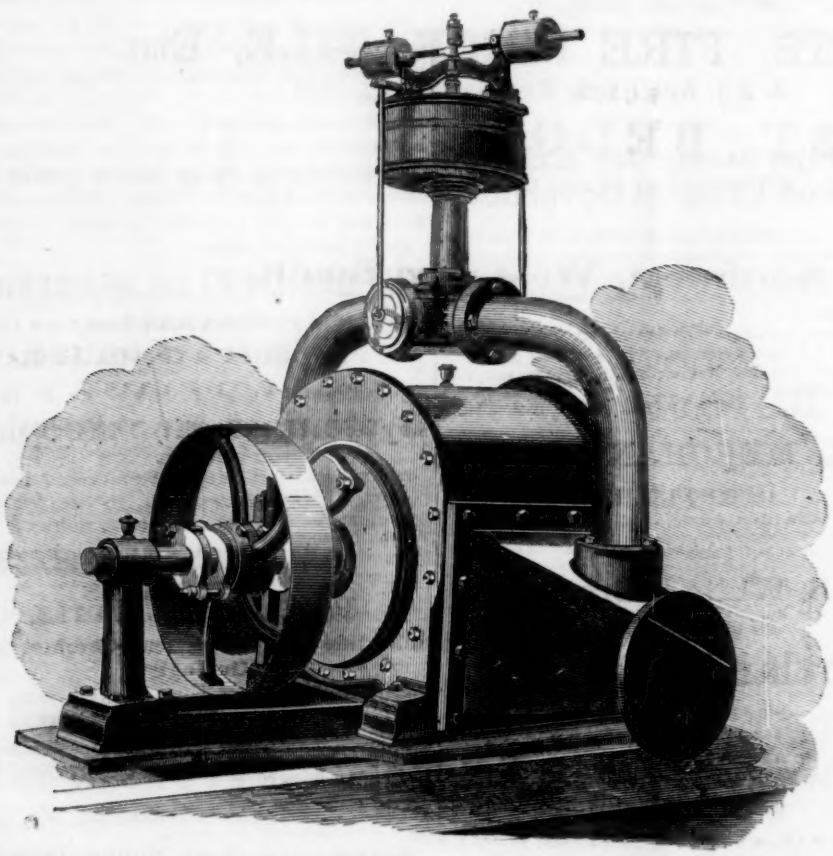

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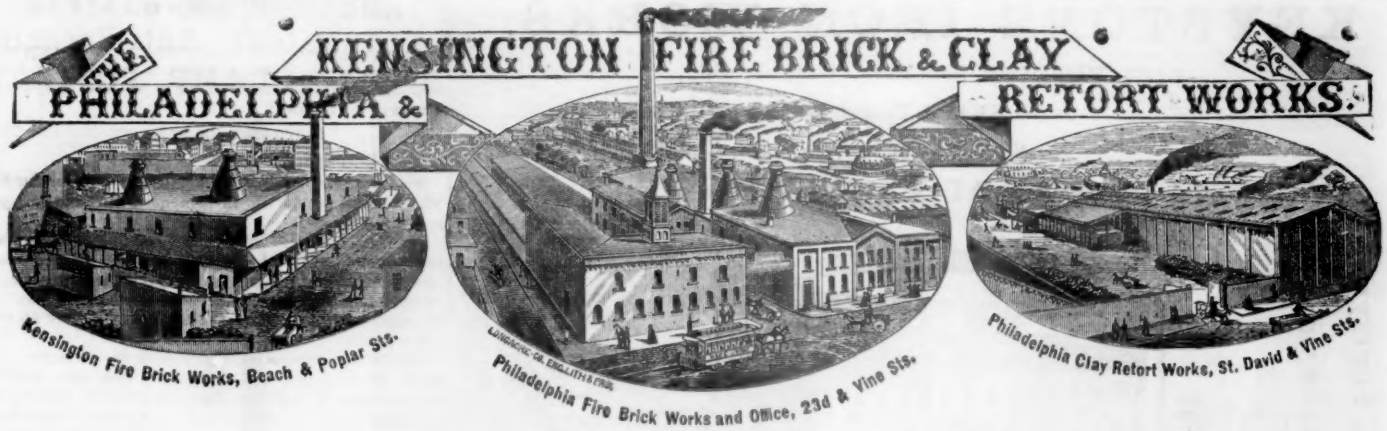
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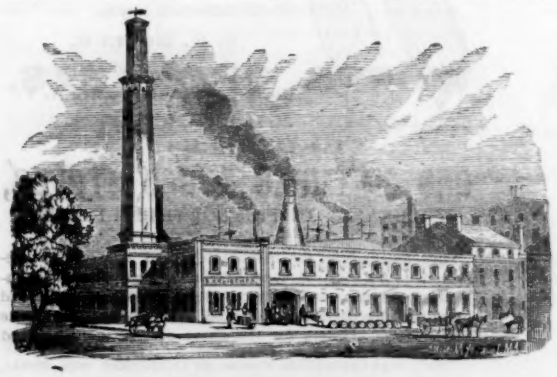

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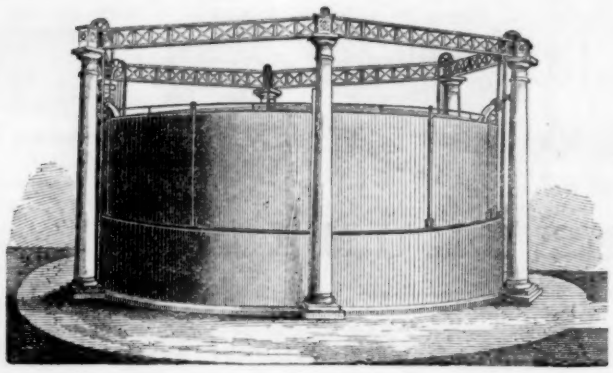

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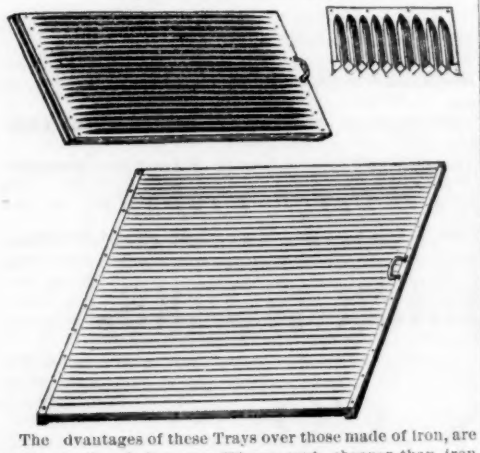

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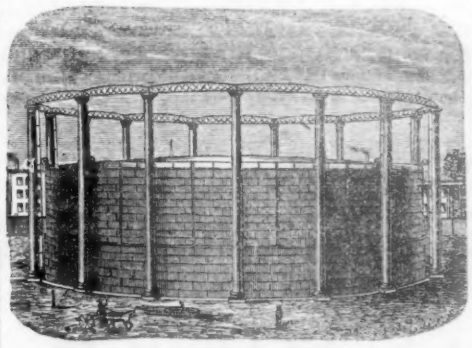

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"Superintendent Water Works.

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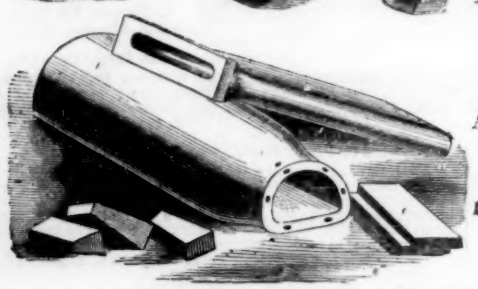

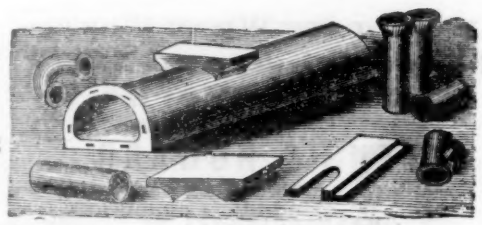

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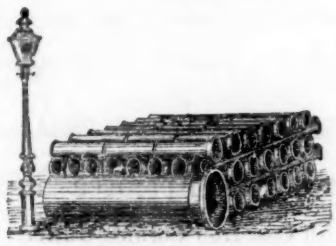

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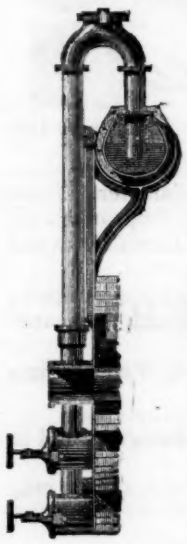

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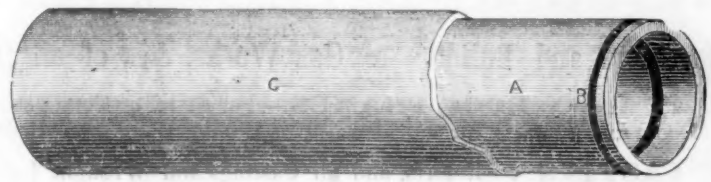

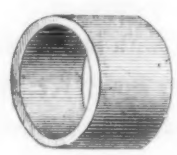

FIG. 2.

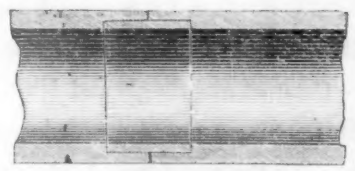

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3—Horizontal Section and Connection.

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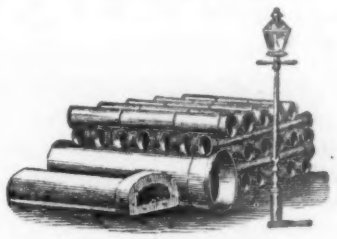

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